PENTAIR

Raychem NGC-30 / UIT2

INSTALLATION MANUAL

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SECTION I – OVERVIEW

1.1 INTRODUCTION

The Raychem NGC-30 is a fully wired and tested control and monitoring system used with electric heat tracing. This manual provides information pertaining to the installation, operation, testing, adjustment, and maintenance of all components of the Raychem NGC-30 System. For information about how to program the Raychem NGC-30, see the Raychem NGC-30 Programming Guide (H58186)

A typical Raychem NGC-30 is made up of at least a User Interface Terminal (NGC-UIT2), one Card Rack (NGC-30-CR), one Card Rack Module with connectors (NGC-30-CRM or NGC-30-CRMS), and one Current Transformer Module (NGC-30-CTM). Optional Remote Monitoring Module (RMM2), Power Line Carrier Interface (PLI) and Voltage Monitoring Module (NGC-30-CVM) may be used.

The information in this document coincides with the specific releases of firmware (listed in Table 1.1) for the User Interface Terminal (NGC-UIT2) and Card Rack Module (NGC-30-CRM/-CRMS) components. As Pentair Industrial Heat Tracing Solutions releases new firmware to significantly modify or enhance any of these components, new documentation will accompany these releases. To ensure that the correct documentation is being used for your particular version of the Raychem User Interface Terminal (NGC-UIT2), compare the firmware version number of each component against the number listed in the table below. As subsequent changes are made, supplements to this document will be included in manuals shipped after the firmware is released. Supplements will make specific reference to the operation or functional change.

Copies of this manual and updates may be downloaded from the Literature section of www.pentairthermal.com.

Table 1.1 Component versions

Component versions	
Component	Version number
NGC-CRM/CRMS	V1.0X
NGC-UIT2-ORD	V2.1.X
NGC-UIT2-HAZ	V3.1.X
RMM2	V1.0X

IMPORTANT WARNINGS AND NOTES

The following icons are used extensively throughout this manual to alert you to important warnings ⚠ that affect safety and to important notes that affect the proper operation of the unit. Be sure to read and follow them carefully.

SECTION2 – INSTALLATION AND WIRING

2.1 INTRODUCTION

⚠ WARNING:

Electrical Hazard! Ensure all personnel involved in installation, servicing, and programming are qualified and familiar with electrical equipment, its ratings, and proper practices and codes. Multiple voltages and signal levels may be present during the installation, operation, and servicing of this product. Do not power the product until the safety provisions outlined in this section have been observed.

This section includes information regarding the initial inspection, preparation for use, and wiring instructions for the components of the Raychem NGC-30.

2.2 INITIAL INSPECTION

Inspect the shipping container for damage. If the shipping container or cushioning material is damaged, it should be kept until the contents of the shipment have been verified for completeness and the equipment has been checked mechanically and electrically. Procedures for installing the Raychem NGC-30 are given in this section. If the shipment is incomplete, mechanically damaged, defective in any way, or does not pass the electrical performance tests, notify the nearest pentair representative. If the shipping container is damaged, or the cushioning material shows signs of stress, notify the carrier as well as your pentair representative. Keep the shipping materials for the carrier's inspection.

2.3 OPERATING ENVIRONMENT

There are three types of User Interface Terminals (UIT2s) available with the Raychem NGC-30 panel, as shown in Table 2.1. The term "NGC-UIT2" in this document refers to any of the available NGC-UIT2s, regardless of which model is actually installed.

NGC-30 User Interface Terminals (UIT2s)

UIT2 type	Area classification	Usage
NGC-UIT2-ORD	Nonhazardous (Unclassified) Locations	TYPE 4 (Indoors or Outdoors)
NGC-UIT2-HAZ	Nonhazardous (Unclassified) Locations Hazardous Locations Class 1 Div. 2, Groups A.B,C & D	TYPE 4 (Indoors or Outdoors)
NGC-UIT2-ORD-R	Nonhazardous (Unclassified) Locations The NGC-UIT2-ORD-R must be installed in a nonhazardous, indoor or outdoor location. The NGC-UIT2-ORD-R connects to NGC-30 panels using RS-485 communication wiring.	TYPE 4 (Indoors or Outdoors)

⚠ WARNING:

Some wiring configurations will use more than one power source. All power sources must be de-energized prior to performing any maintenance on a card rack module or its heating circuit. The operating environment should be within the limitations specified for the Raychem NGC-30 components as outlined in Appendices B, C, and D.

2.4 INSTALLATION LOCATION

The wide Operating Temperature range of the Raychem NGC-30 permits installation in almost any convenient location. Considerations should include: expected atmospheric conditions (weather), accessibility for maintenance and testing, the location of existing conduits, and hazardous location rating. Ambient temperature conditions may affect load current ratings

⚠ CAUTION:

Always be sure that the intended location is classified as an area that the product is approved for use in as defined by Article 500 of the National Electrical Code and/or Part I, Section 18 of the Canadian Electrical Code.

2.5 MOUNTING PROCEDURES

Each Raychem NGC-30 panel includes a set of "As Built" drawings that have been engineered, designed, and drafted based upon the model number and any special requirements that were requested when ordering. The "As Built" drawings include an elevation/layout (with bill of materials) and schematics. If these drawings are not included, contact your pentair Representative and request the "As Built" drawings for your panel. Upon request, an electronic copy of these drawings can be provided.

For mounting the panel, locate the elevation and layout drawing which includes a bill of materials. The enclosure mounting information will be provided on the "As Built" drawings.

2.6 WIRING PROCEDURES

Refer to the "As Built" drawings for wiring of incoming/outgoing power and incoming RTD connections. The Raychem NGC-30 panel can be purchased with, or without, a distribution panel board.

2.6.1 INCOMING POWER WITH DISTRIBUTION SYSTEM

Main Circuit Breaker

Locate the main circuit breaker in the panel by using the supplied elevation/layout drawing, and connect per the associated schematic drawings. Depending upon the size and type of main circuit breaker and voltage loss calculations, use the appropriate size and number of wires to connect directly to the main circuit breaker, and panel board neutral and ground bus in the panel.

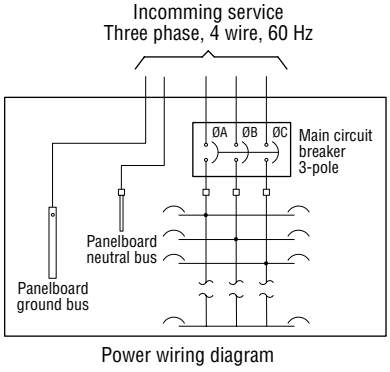


Fig. 2.1 Main circuit breaker wiring

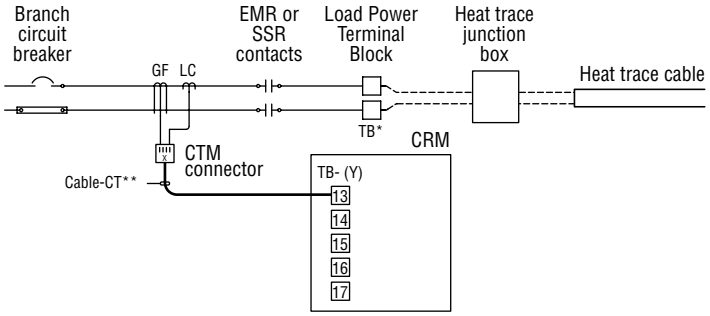
Branch Circuit Breakers

The branch circuit breakers are pre-wired to the contactors or solid- state relays in the panel, so no further incoming power wiring is required.

2.6.2 OUTGOING POWER WITH DISTRIBUTION SYSTEM

Load Power Terminal Blocks

Locate the outgoing heater terminal blocks using the supplied elevation/layout drawing, and connect per the associated schematic drawings. Depending upon the size of the branch circuit breaker and voltage loss calculations, use the appropriate size and number of wires to connect from the panel's Load Power Terminal Blocks to the heat-trace power junction box.



* Reference panel drawing for terminal block number
** Represents HTC circuit number 1-40

Fig. 2.2 Heat trace power wiring diagram

2.6.3 INCOMING/OUTGOING POWER WITHOUT DISTRIBUTION PANEL BOARD

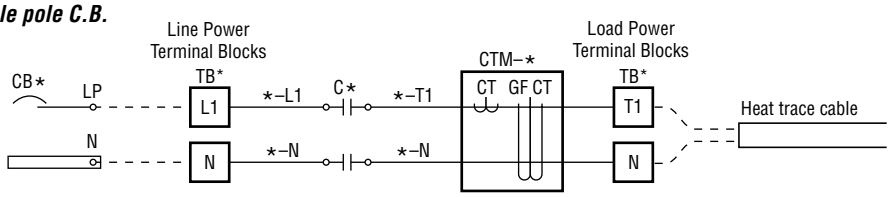
Line Power Terminal Blocks

Locate the incoming power terminal blocks in the panel using the supplied elevation/layout drawings and connect per the associated schematic drawing. Depending upon size and type of the remotely located branch circuit breakers, use the appropriate size and number of wires to connect directly to the Line Power Terminal Blocks.

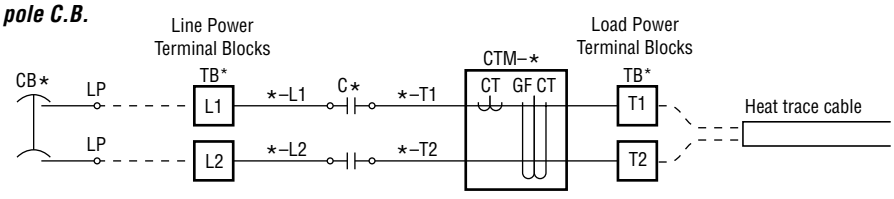
Load Power Terminal Blocks

Locate the outgoing power terminal blocks in the panel using the supplied elevation/layout drawings and connect per the associated schematic drawing. Depending upon size and type of the remotely located branch circuit breakers, use the appropriate size and number of wires to connect from the Load Power Terminal Blocks to the heater's power connection box.

Single pole C.B.



Two pole C.B.



* Reference panel drawing for terminal block number

Fig. 2.3 Single pole and two pole circuit breaker wiring diagrams

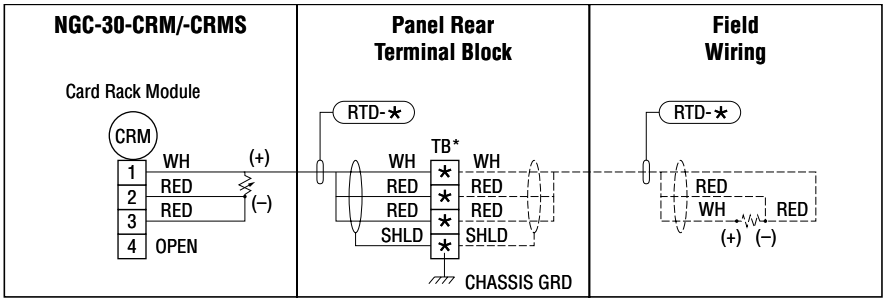
2.6.4 INCOMING RTD WIRING

Nonhazardous and Hazardous Location Installations Wired to Terminal Block in Panel

The RTD wiring from the NGC-30-CRM/-CRMS have been pre-wired to RTD terminals. The field RTD wiring (3-wire with shield) will be terminated by the installer at the RTD terminal blocks. Refer to the Installation Drawings for the RTD Termination Schedule.

See Fig. 2.4 on page 8 for a typical RTD installation.

IMPORTANT: To meet the requirements for hazardous location installations, a separate RTD terminal block must be installed and wired to the NGC-30-CRM/-CRMS RTD terminal connector.



* Reference panel drawing for terminal block number

Fig. 2.4 Typical RTD installation

2.6.5 CONNECTING THE RS-485 DEVICE NETWORK

The NGC-UIT2 display is typically linked to a network of Raychem NGC-30-CRMs/-CRMSs and optional RMM2s and PLIs. These are connected to the Raychem NGC-UIT2 using an RS-485 communication cable (shielded, two conductor, twisted pair). The following illustration shows how the RS-485 network for the NGC-UIT2 system may be configured.

Device must be mounted in series.

(Terminated devices are shown in gray)

Branching of the network is not allowed.

Connect no more than two RS-485 cables to any device.

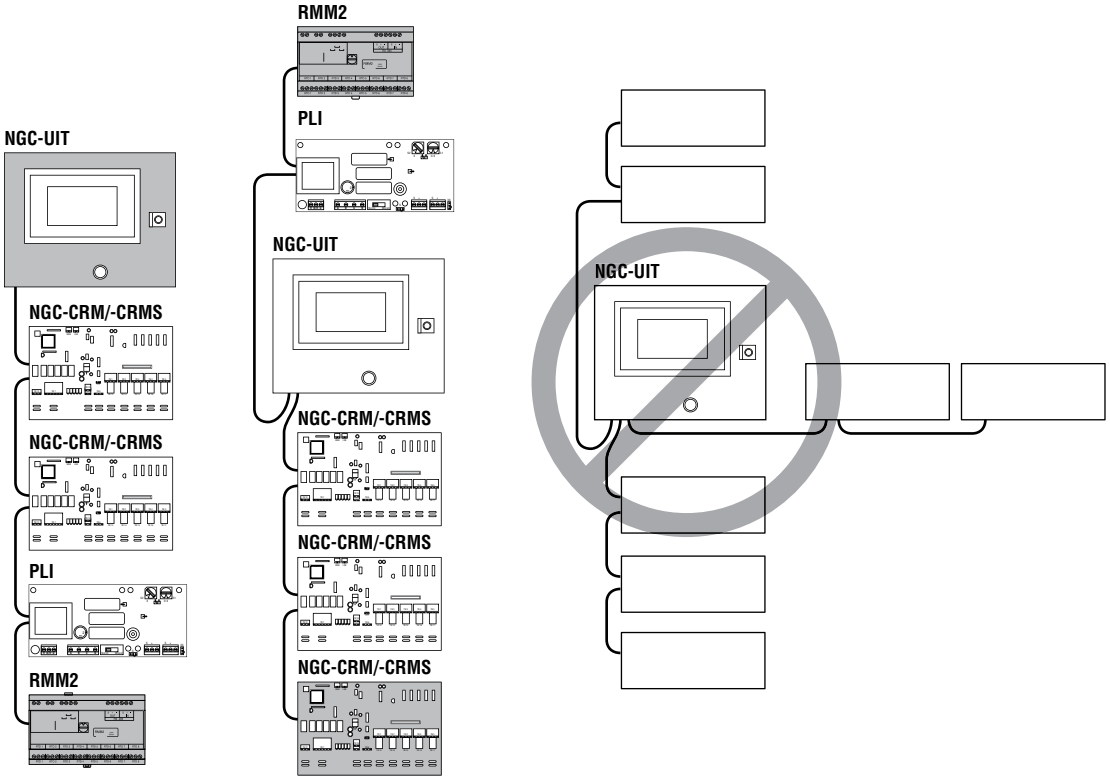


Fig. 2.5 RS-485 network configuration for the NGC-UIT2 system

In order for the RS-485 network to work properly, you must enable the termination resistor for the first and last device. The devices shown in gray in Fig. 2.5 represent the devices for which you must enable the termination resistors. The devices that are not grayed out represent the devices for which you should not enable the termination resistors.

Optional RMM2 Installed in the Field

Refer to the RMM2 Installation Instructions (H56848) for field installation instructions. You must connect a RS-485 connection from the RMM2 to an open RS-485 connector on the NGC-30-CRM/-CRMS board in the Raychem NGC-30 panel. To make this connection, a pre-wired terminal block has been provided in the Raychem NGC-30 panel. Connect the RS-485 wire from the RMM2 to TB (per the panel drawing) while maintaining the correct polarity. If the RMM2 is the first or last device in the RS-485 network, connect the J17 termination jumper to pins 1 and 2. If the RMM2 is not the first or last device in the RS-485 network, connect the J17 termination jumper to pins 2 and 3.

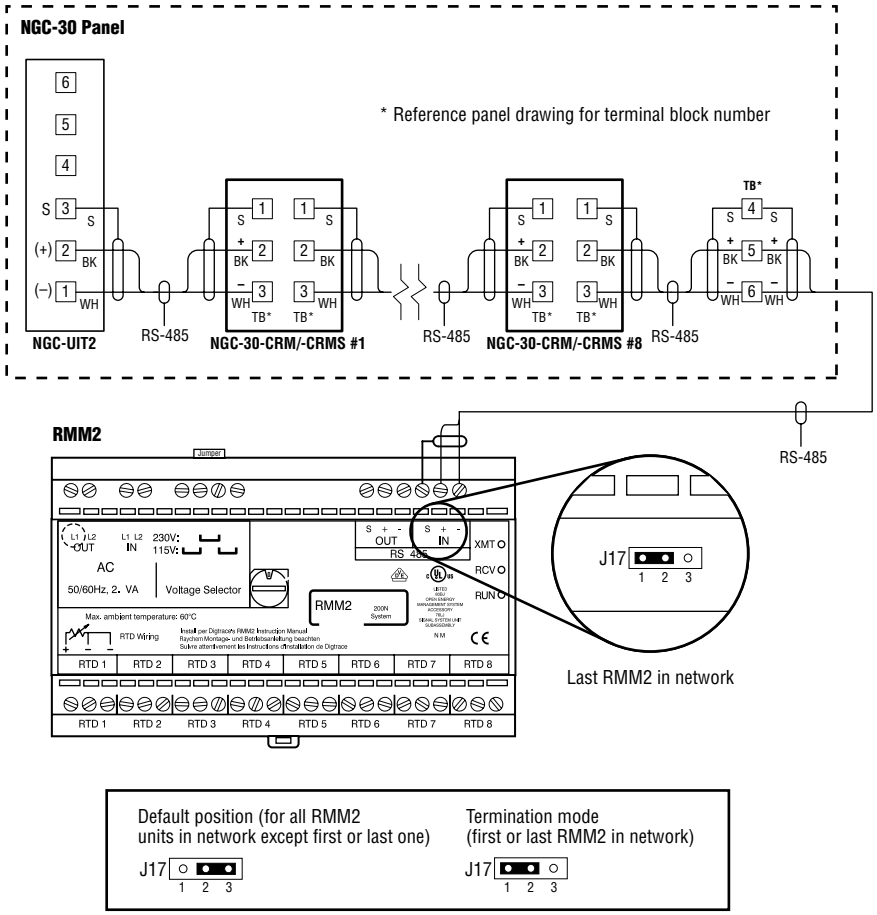
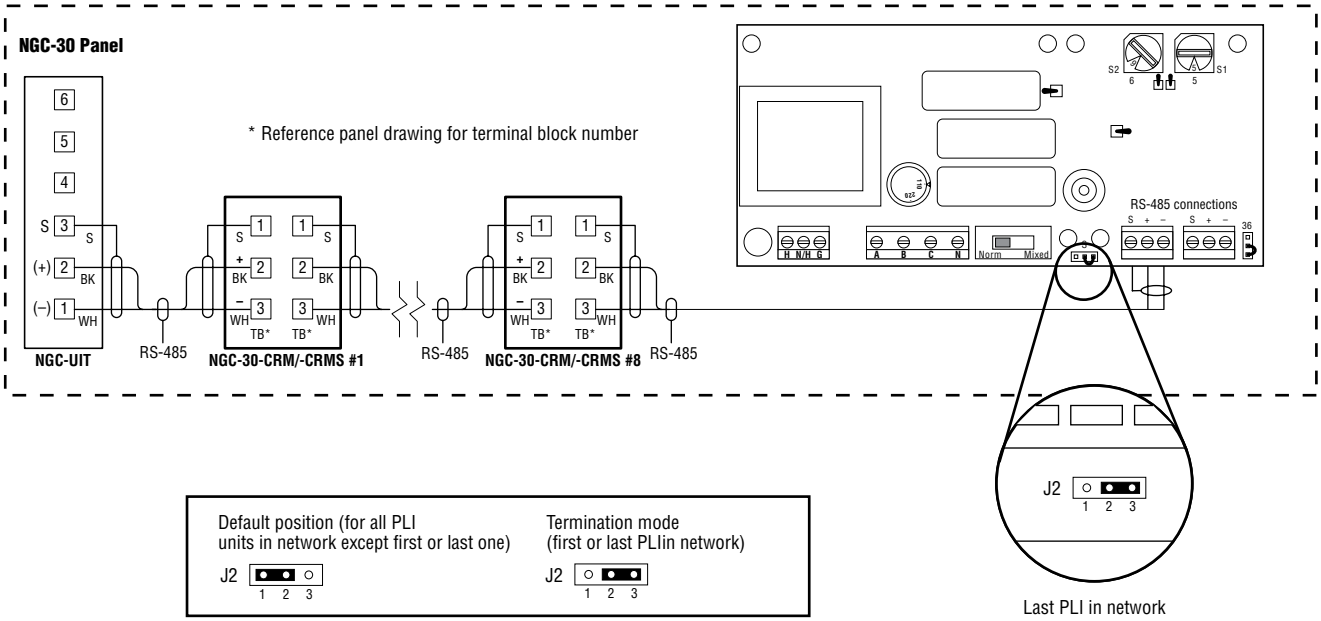


Fig. 2.6 RMM2 RS-485 field wiring and termination jumper setting

Optional PLI Installed in the Panel

Refer to the PLI Installation Instructions (H56850). You must connect a RS-485 connection from the PLI to an open RS-485 connector on the NGC-30-CRM/-CRMS board in the Raychem NGC-30 panel. IF the PLI is the first or last device in the RS-485 network, remove the shorting block jumper location J2 from 1 and 2 and place it across pins 2 and 3.



Default position (for all PLI units in network except first or last one)
J2
1 2 3
Termination mode (first or last PLIin network)
J2
1 2 3

Fig. 2.7 PLI RS-485 panel wiring and termination jumper setting

NGC-UIT2 Installation

The NGC-UIT2-ORD and NGC-UIT2-HAZ will come pre-wired into any NGC-30 panel. Exceptions exist when a remote mount NGC-UIT2 (NGC-UIT2-ORD-R) is used or the NGC-30 panel is wired to the NGC-UIT2 in another panel. Fig. 2.8 shows the wiring for the NGC-UIT2-ORD-R and Fig. 2.10 shows the wiring between a separate panel and the NGC-UIT2.

NGC-UIT2-ORD-R Installation

You must make an RS-485 connection from the NGC-UIT2-ORD-R to the NGC-30-CRM/-CRMS board in the NGC-30 panel. To make this connection, a pre-wired terminal block has been provided in the NGC-UIT2-ORD-R and in the NGC-30 panel. Connect the RS-485 wire from TB3 in the NGC-UIT2-ORD-R and the other end to TB* in the NGC-30 panel maintaining the correct polarity. If the NGC-UIT2-ORD-R and/or the NGC-30-CRM/-CRMS is the first or last device in the RS-485 network, see Fig. 2.9 and Table 3.1 for details on how to terminate the RS-485 network.

* Reference panel drawing for terminal block numbers.

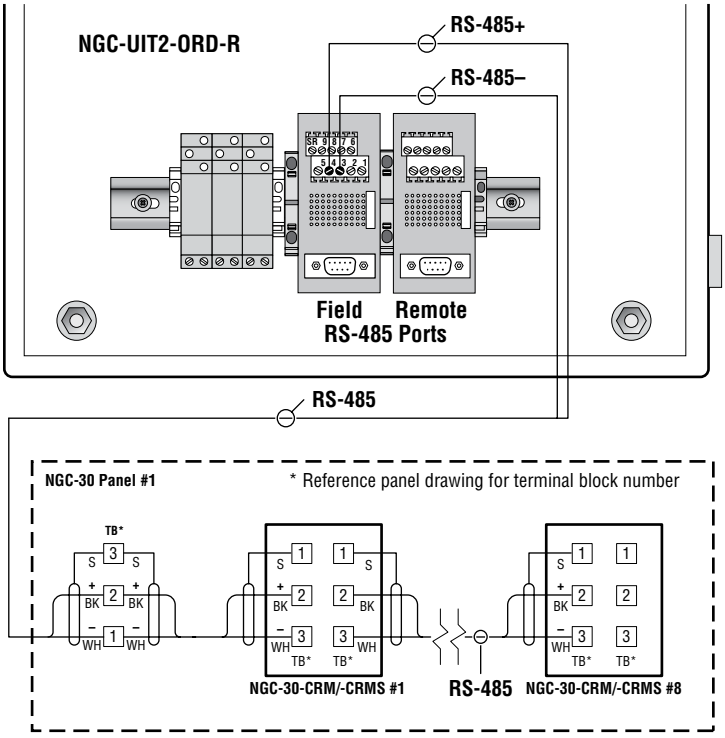


Fig. 2.8 NGC-UIT2 RS-485 field wiring

The following figure shows the RS-485 termination options for the NGC-30-CRM/-CRMS.

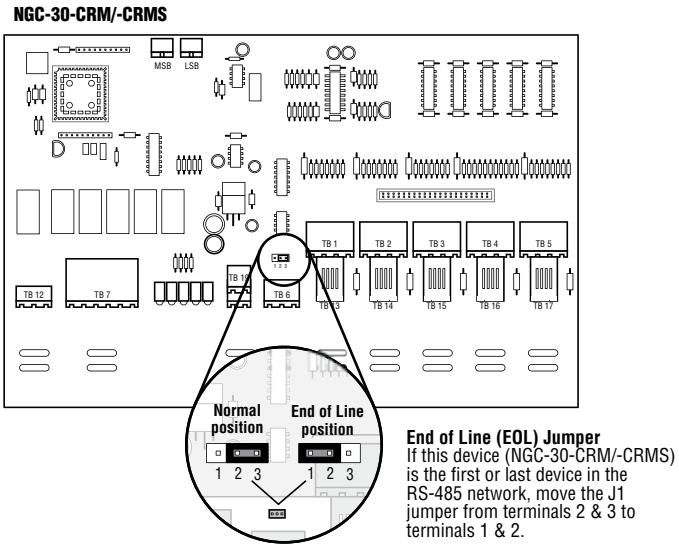

NGC-30-CRM/-CRMS
Normal position
End of Line position
End of Line (EOL) Jumper
If this device (NGC-30-CRM/-CRMS) is the first or last device in the RS-485 network, move the J1 jumper from terminals 2 & 3 to terminals 1 & 2.

Fig. 2.9 Termination of RS-485 network for NGC-30-CRM/-CRMS

NGC-30 Panel with NGC-UIT2 Connected to an NGC-30 Panel without NGC-UIT2

This wiring is used when a single UIT2 in one panel is the central point for multiple NGC-30 panels. Because the NGC-UIT2 can handle up to 260 heat tracing circuits, it can be cost effective to use one NGC-UIT2 for multiple panels. An RS-485 connection must be made from the panel that has the NGC-UIT2 (panel #1) installed to the NGC-30-CRM/-CRMS board in NGC-30 (panel #2) that does not have the NGC-UIT2 installed (see Fig. 2.10). To make this connection, a pre-wired terminal block has been provided in the panel #1 and in panel #2. Connect the RS-485 wire from TB* in panel #1 and the other end to TB* in panel #2 maintaining the correct polarity. If the NGC-30-CRM/-CRMS is the first or last device in the RS-485 network, see Fig. 2.9 and Table 3.1 for details on how to terminate the RS-485 network.

* Reference panel drawing for terminal block numbers.

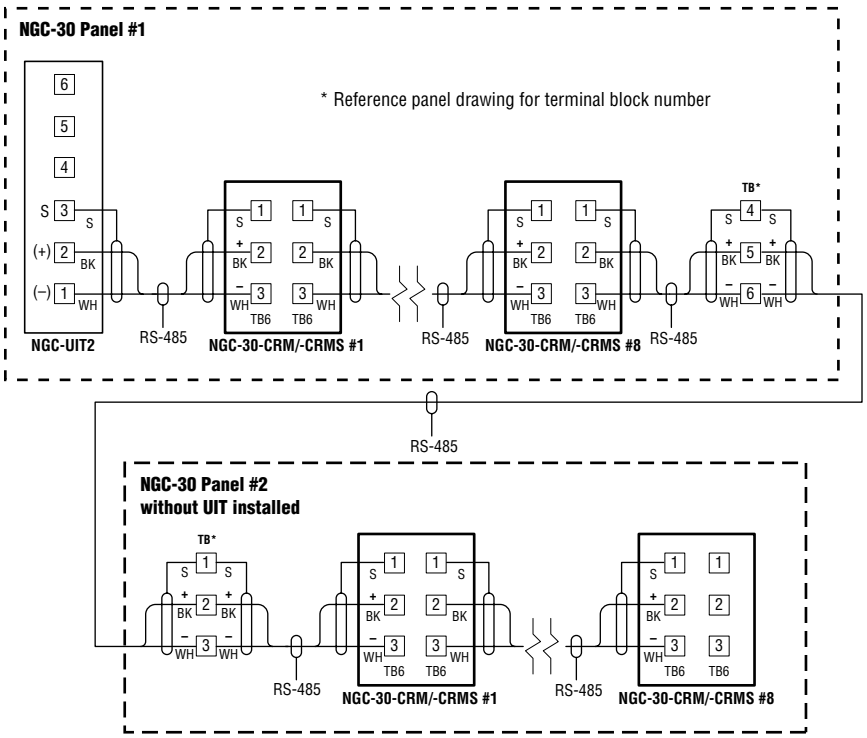


Fig. 2.10 RS-485 field wiring between two Raychem NGC-30 panels

2.7 CONNECTIONS FOR REMOTE ANNUNCIATION — NGC-UIT2-ORD

Relay 1 on the NGC-UIT2-ORD has been factory-configured and wired for "Any Alarms" unless otherwise specified. It is powered by 12 Vdc and will energize a light on the front of the panel if any alarm occurs. Relay 1 was also wired to a common alarm relay/terminal block for remote annunciation of any alarms. Please see below the NGC-UIT2 Relay 1 in non-energized, energized and in alarm condition.

NGC-UIT Relay 1

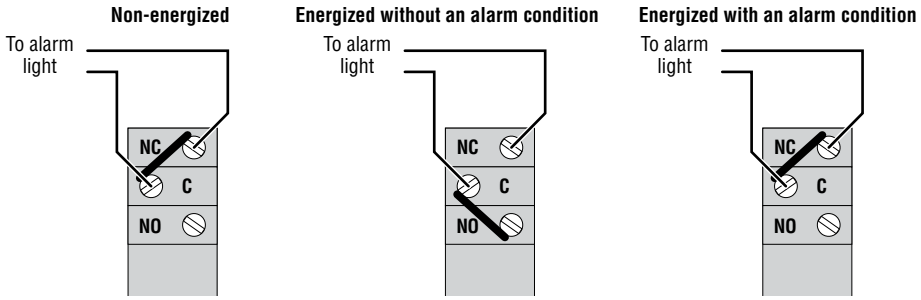
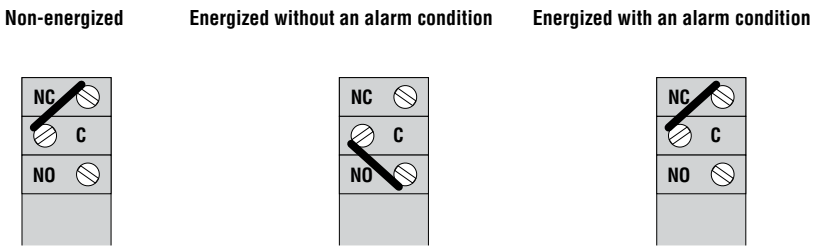


Fig. 2.11 Relay 1 wiring

The NGC-UIT2 has two other Form C alarm relays (configurable through the NGC-UIT2 program) for external alarms. Each relay can be connected to an annunciator light or distributed control system. Each relay's contacts have been wired from the NGC-UIT2 to a terminal block in the panel.

NGC-UIT Relay 2



NGC-UIT Relay 3

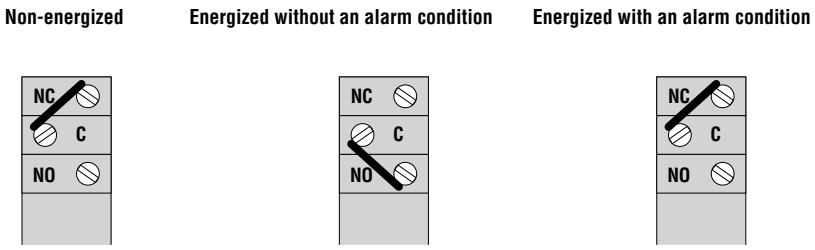
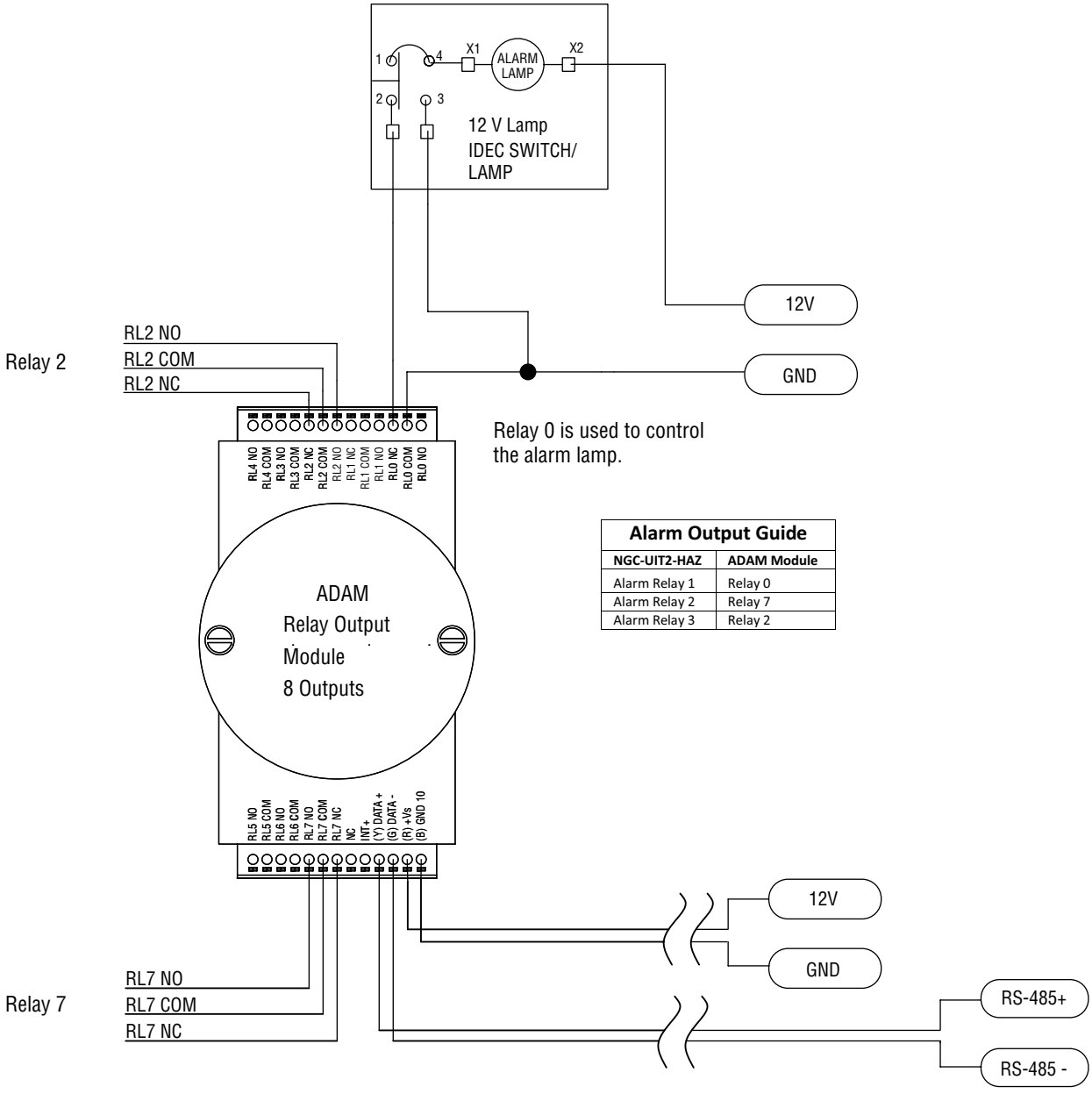


Fig. 2.12 Relays 2 and 3 wiring

IMPORTANT: An energized relay with no alarm condition will change state with loss of power or an alarm condition.

2.8 CONNECTIONS FOR REMOTE ANNUNCIATION — NGC-UIT2-HAZ

Relay0 on the ADAM alarm module has been factory-configured and wired for "Any Alarms" unless otherwise specified. It is powered by 12 Vdc and will energize a light on the front of the panel if any alarm occurs. Relay 2 and 7 are also available for remote annunciation of any alarms. Please note that the relays shown below are in a non-energized state.



Alarm Output Guide

NGC-UIT2-HAZ	ADAM Module
Alarm Relay 1	Relay 0
Alarm Relay 2	Relay 7
Alarm Relay 3	Relay 2

Fig. 2.13 NGC-UIT2-HAZ

2.9 RS-232, RS-485, OR ETHERNET REMOTE PORT CONNECTIONS TO A HOST COMPUTER

The NGC-UIT2 can communicate with a distributed control system (DCS) or other host computer through the NGC-UIT2 external communication ports. The NGC-UIT2 provides ports for RS-232, RS-485, and Ethernet communication. All of these communication ports provide data read access. However, only one port can be assigned read/write access. This is done using the NGC-UIT2.

2.9.1 RS-232 SERIAL CONNECTIONS

The RS-232 port can be used as a direct connection to a single PC located within 50 feet of the panel. (Refer to Fig. 2.14 on page 16). For an RS-232 connection, a 5-foot long 9-pin female D connector to 9-pin female D-connector null modem cable has been provided with the NGC-UIT2. Using the supplied cable, plug one end into the RS-232 port on the NGC-UIT2 and the other end into the 9-pin male connector on the user's computer.

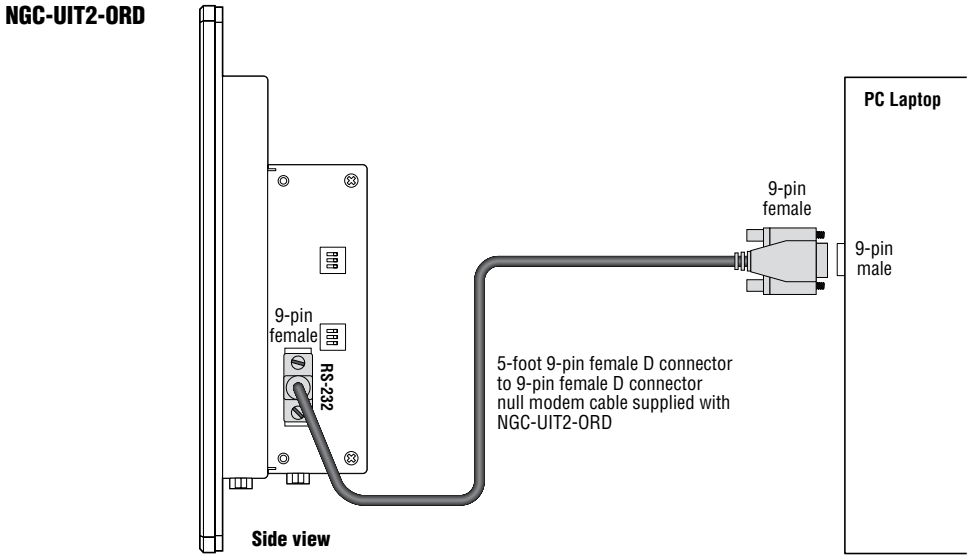


Fig. 2.14 RS-232 connection

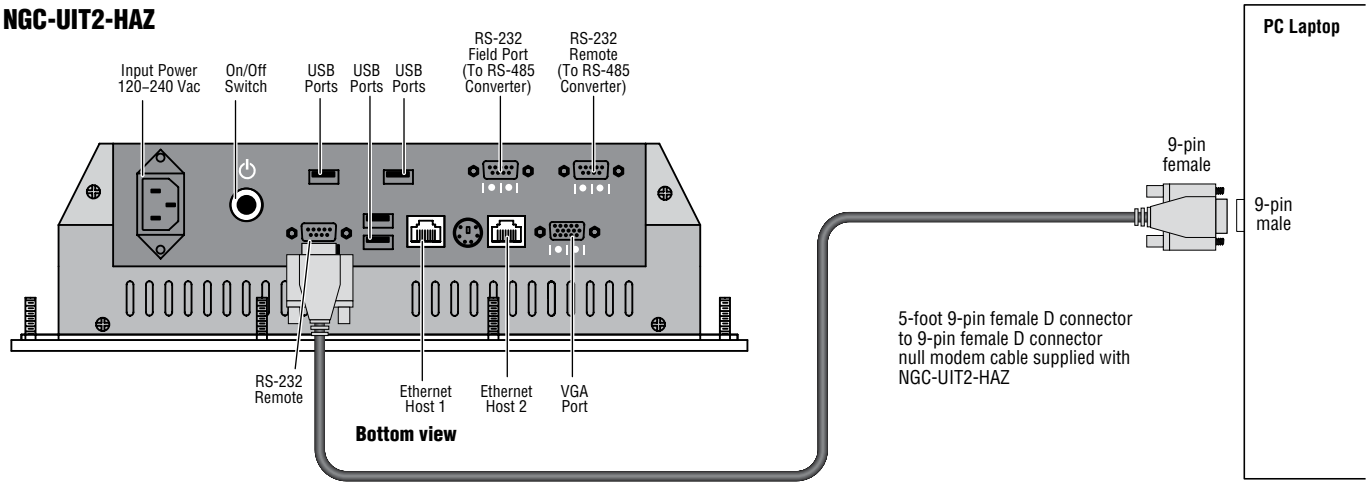


Fig. 2.15 RS-232 connection

2.9.2 RS-485 SERIAL CONNECTIONS

Use the RS-485 port when multiple NGC-UIT2 units are to be connected to a host computer or the connection is longer than 50 feet. An RS-485 to RS-232 or RS-485 to USB converter may be required to make the connection to the user's PC.

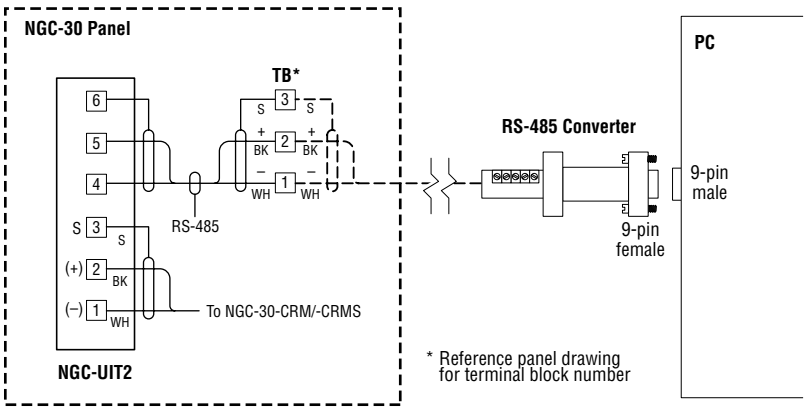


Fig. 2.16 RS-485 connection

2.9.3 ETHERNET CONNECTIONS

The Ethernet port can be used to connect multiple NGC-UIT2 units to a host computer by connecting to the user's LAN system.

NGC-UIT2-ORD

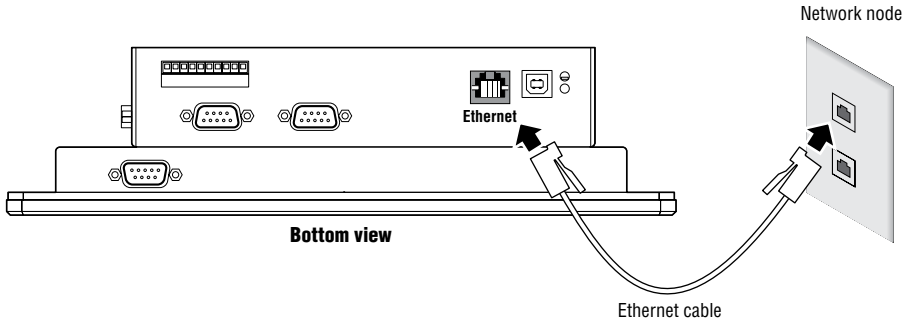


Fig. 2.17 Ethernet connection (NGC-UIT2-ORD)

NGC-UIT2-HAZ

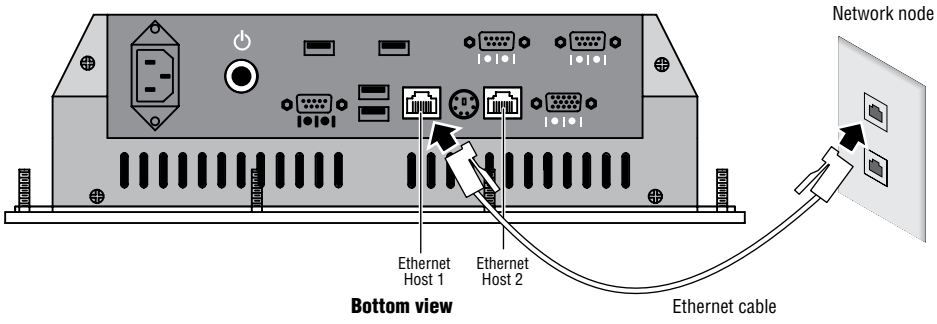


Fig. 2.18 Ethernet connection (NGC-UIT2-HAZ)

2.10 TESTING THE NGC-30 SYSTEM

Once the wiring to the panel has been finished, confirm that it was done properly by completing the following steps:

1. Turn the power on to all network devices (NGC-30-CRMs/-CRMSs and optional RMM2s & PLI modules) and the NGC-UIT2.
2. Once the NGC-UIT2 has booted up to the Main screen, Go to the Network | Device Screen and press "Update Network."

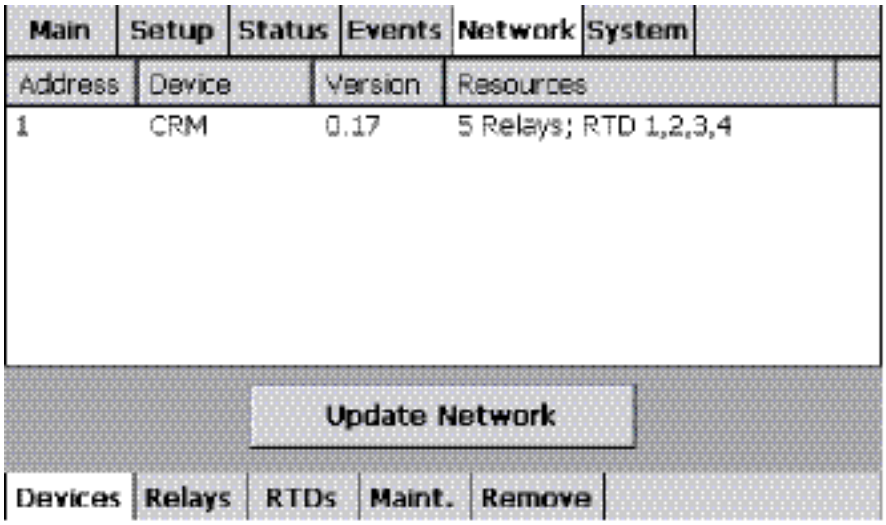


Fig. 2.19 Network|Devices screen

3. Confirm all NGC-30-CRM/-CRMS, RTDs and/or RMM2s and PLI modules have been scanned into the Network database.
4. If a device or an RTD is installed but does not show up in the Network | Devices Screen, turn the power off to the system and:

For Devices:

a. Confirm the device has a unique address (refer to section 3.2 on page 24)
b. Confirm the device is being powered
c. Confirm the RS-485 connection is in place with the correct polarity (refer to section 2.6.5)

For RTDs:

a. Confirm the RTD connection is in place with the correct polarity
b. Perform a resistance check of the RTD. The resistance should be in a range of 70–250 ohms

Turn the power on to all devices (NGC-30-CRMs/-CRMSs and optional RMM2s & PLI) and the NGC-UIT2. Once the NGC-UIT2 has booted up to the Main screen, Go to the Network | Device Screen and press "Update Network." Confirm all NGC-30-CRM s/ -CRMSs, RTDs, and/or RMM2s and PLI modules have been scanned into the Network database.

The Raychem NGC-30 heat-trace system is comprised of a number of modular components, allowing the ultimate in design flexibility. This section describes the NGC-30 control and monitoring components (excluding the optional distribution section). Appendix B, C, and D includes the specifications for these components.

3.1 USER INTERFACE TERMINAL (NGC-UIT2)

The NGC-UIT2 is a panel mounted color LCD display with touch-screen overlay. The NGC-UIT2 includes software that interfaces with the Card Rack Modules (NGC-30-CRM and NGC-30-CRMS) and the Remote Monitoring Module (RMM2) and Power Line Carrier Interface (PLI) module. The NGC-UIT2 is used as a control panel, setup device and user display.

3.1.1 MULTIPLE NGC-UIT2 MODELS

There are three versions of User Interface Terminals (UITs) available as specified in Table 2.1, "NGC-30 User Interface Terminals (UIT2s)," on page 5. All versions use the same programming, however the wiring system interface is different for the NGC-UIT2-HAZ versus the NGC-UIT2-ORD and NGC-UIT2-ORD-R. The term "NGC-UIT2" in this document refers to any of the available NGC-UITs, regardless of which model is actually installed.

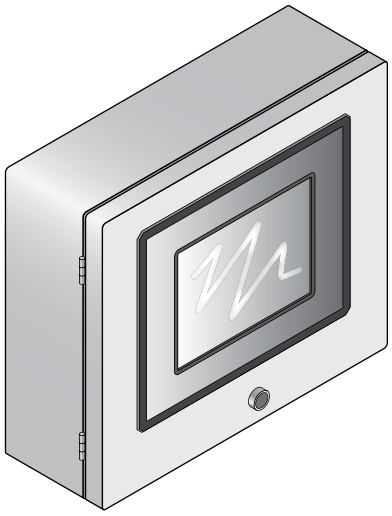


Fig. 3.1 Typical NGC-UIT2 model showing NGC-UIT2-ORD-R remote user interface terminal

The physical dimensions of each NGC-UIT2 model vary; the dimensions of the NGC-UIT2-ORD-R shown in the figure are the largest of all NGC-UITs:

- Width: 15.21" (386 mm)
- Height: 13.21" (336 mm)
- Depth: 7.09" (180 mm)

NGC-UIT2 LCD Touch-Screen Display

Each NGC-UIT2-ORD and NGC-UIT2-ORD-R has a 7 inch wide x 5 ¼ inch high LCD (17.5 cm X 13.3 cm) LCD color display. The NGC-UIT2-HAZ has a 10.4 inch LCD color display. All NGC-UIT2 have touch-screen technology that provides an user interface easy and efficient programming with no keyboards or cryptic labels.

3.1.2 NGC-UIT2 LOCAL AND REMOTE NETWORK CONNECTIONS

The NGC-UIT2 communicates to both a local field network and optionally to a remote monitoring and control network.

Local Field Network Connection

The local field network always uses an RS-485 serial connection running over shielded twisted-pair cable. This network is used to connect the NGC-UIT2 to its control and monitoring modules:

- Raychem Mechanical Contactors Controller - NGC-30-CRM
- Raychem Solid State Relay Controller - NGC-30-CRMS
- Raychem Current Transformer Module Controller - NGC-30-CTM
- Raychem Voltage Monitoring Module - NGC-30-CVM
- Raychem Remote Monitoring Module - RMM2
- Raychem Power Line Carrier Interface Module - PLI

The local field network must follow configuration rules about topology and termination of network end devices.

Remote Monitoring and Control Network Connection

The remote monitoring and control network communicates via a selectable network connection port using either RS-485, RS-232, or 10/100Base-T Ethernet. This network is used to connect to multiple NGC-UIT2 systems and communicate with a central PC running Raychem Supervisor software. The Raychem Supervisor software provides centralized status and alarm monitoring, data logging, and remote configuration control over all attached NGC-UIT2 systems in the network. The remote monitoring and control network must also follow configuration rules about topology and termination of the network end devices.

NGC-UIT2-ORD

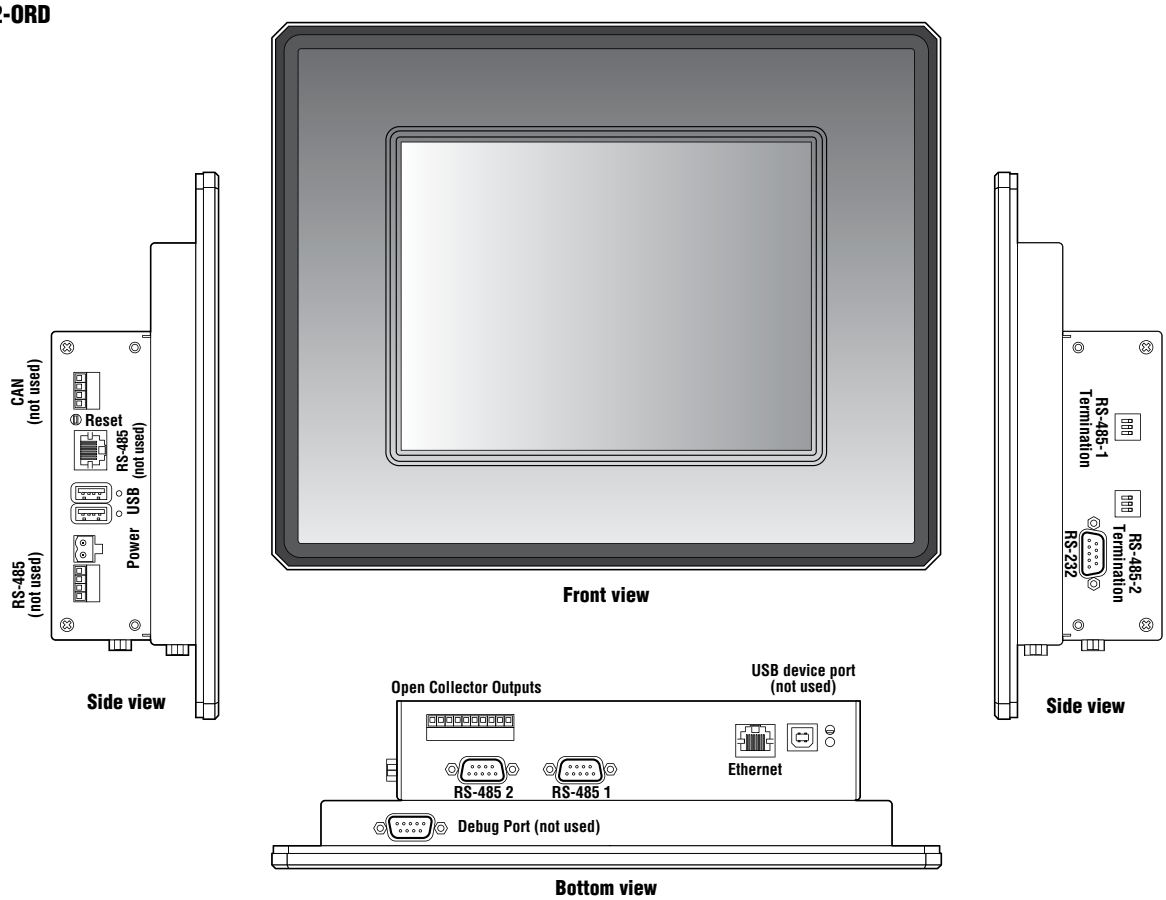


Fig. 3.2 NGC-UIT2-ORD touch-screen display, controls, and connections

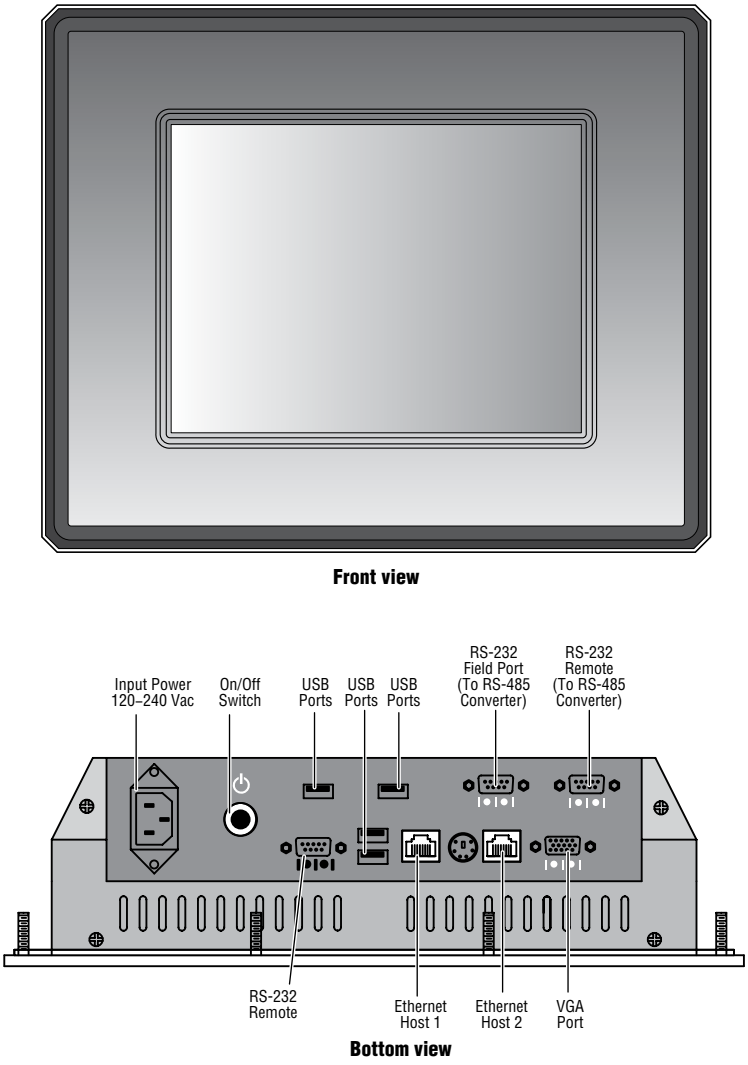
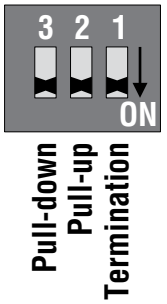


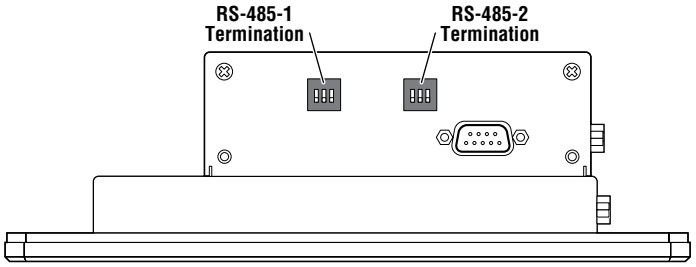
Fig. 3.3 NGC-UIT2-HAZ touch-screen display, controls, and connections

3.1.3 RS-485 CONFIGURATION SWITCHES

The configuration switches are found on the right side of the NGC-UIT2-ORD. Refer to table 3.1 for settings.

Table 3.1 NGC-UIT2-ORD Co-nfiguration Switch Functions

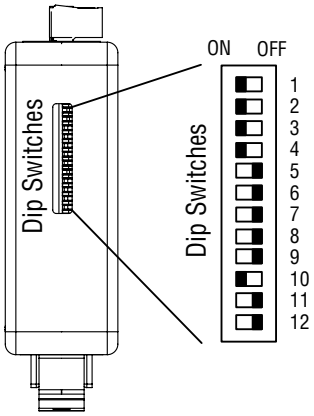




Pull-down	(As-shipped default) RS-485 network "–" signal **is forced** to a determinate state when idle.	RS-485 network "–" signal **is not forced** to a determinate state when idle.	One and only one device (typically this NGC-UIT2-ORD) on the RS-485 network should force the network "-" signal to a determinate state.
Pull-up	(As-shipped default) RS-485 network "+" signal **is forced** to a determinate state when idle.	RS-485 network "+" signal **is not forced** to a determinate state when idle.	One and only one device (typically this NGC-UIT2-ORD) on the RS-485 network should force the network "+" signal to a determinate state.
Termination	(As-shipped default) RS-485 network **is terminated** with 120-ohm resistor.	RS-485 network **is not terminated**.	Terminate the device (NGC-UIT2-ORD or other) that is at each end of the RS-485 network, for a total of two terminated devices. No other devices on the network should be terminated.

3.1.4 NGC-UIT2-HAZ

The configuration switches for the NGC-UIT2-HAZ are found on the RS-232 to RS-485 converters located in the panel on a DIN rail. Refer to Table 3.4 for settings.



Dip Switches		
Switch Number	**Function**	**Position**
1	RS-485 2 Wire Half Duplex	ON
2	RS-485 2 Wire Half Duplex	ON
3	RS-485 2 Wire Half Duplex	ON
4	RS-485 2 Wire Half Duplex	ON
5	Termination Resistor 120 Ω	See note
6	Transmit Bias Resistor 1.2 K Ω	OFF
7	Receiver Bias Resistor 1.2 K Ω	OFF
8	Baud Rate	See Chart
9	Baud Rate	See Chart
10	Baud Rate	ON
11	Baud Rate	See Chart
12	Baud Rate	See Chart
Note: The termination must be ON if the display is at the beginning of the communication loop and OFF if in the middle of the loop.		

Baud Rate Chart (Dip Switches 8–12)					
Baud Rate	**8**	**9**	**10**	**11**	**12**
2400	ON	OFF	OFF	OFF	OFF
4800	OFF	ON	OFF	OFF	OFF
9600	OFF	OFF	ON	OFF	OFF
19200	OFF	OFF	OFF	ON	OFF
38400	OFF	OFF	OFF	OFF	ON
Switch positions shown for 9600 Baud. This is the default Baud rate for both FIELD and REMOTE RS-485 comm ports.					

Fig. 3.4 Configuration settings for NGC-UIT2-HAZ

3.1.5 NGC-UIT2-ORD RESET SWITCH

The reset switch is located on the side of the NGC-UIT2-ORD panel. A pointed object is required to press the restart switch and restart the UIT2 software.

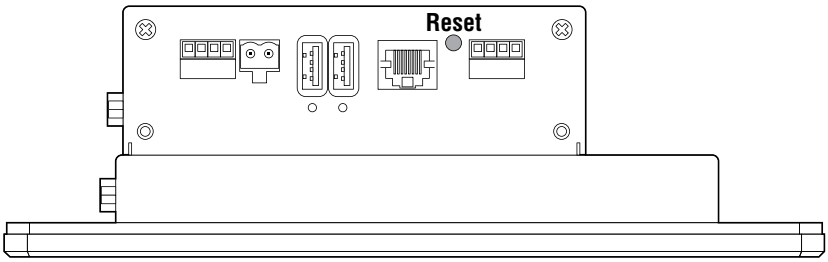


Fig. 3.5 Reset switch

3.2 CARD RACK MODULE (NGC-30-CRM/-CRMS) AND CURRENT TRANSFORMER MODULE (NGC-30-CTM)

Each Card Rack Module (NGC-30-CRM and NGC-30-CRMS) and Current Transformer Module (NGC-30-CTM) provide ground-fault and line current sensing, alarming, switching, and RTD input for five Loops. The NGC-30-CRM is used with electromechanical relays. The NGC-30-CRMS is used with solid-state relays. The NGC-30-CRM/-CRMS may be connected to one User Interface Terminal (NGC-UIT2).

Each NGC-30-CRM/-CRMS must have a unique communication address. The valid address switch range for the NGC-UIT2 is 1–99. SW1 is the ones digit (0–9) and SW2 is the tens digit

(0–9). See Fig. 3.6.

IMPORTANT: RMM2s use ModBus addresses 32 through 47 and PLIs use Modbus addresses 1-99. When using RMM2s and PLI modules in an NGC-30 system, care must be taken to not assign the same addresses to an RMM2, PLI module or an NGC-30-CRM/-CRMS board.

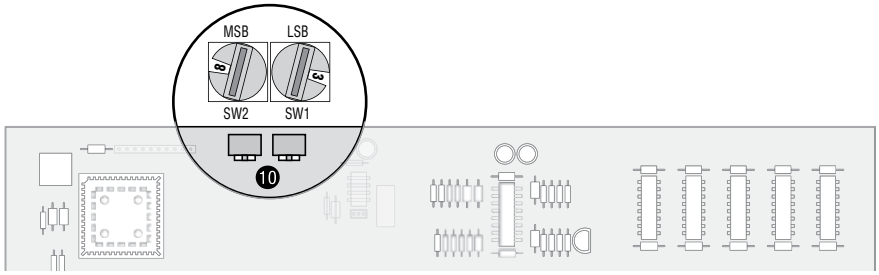
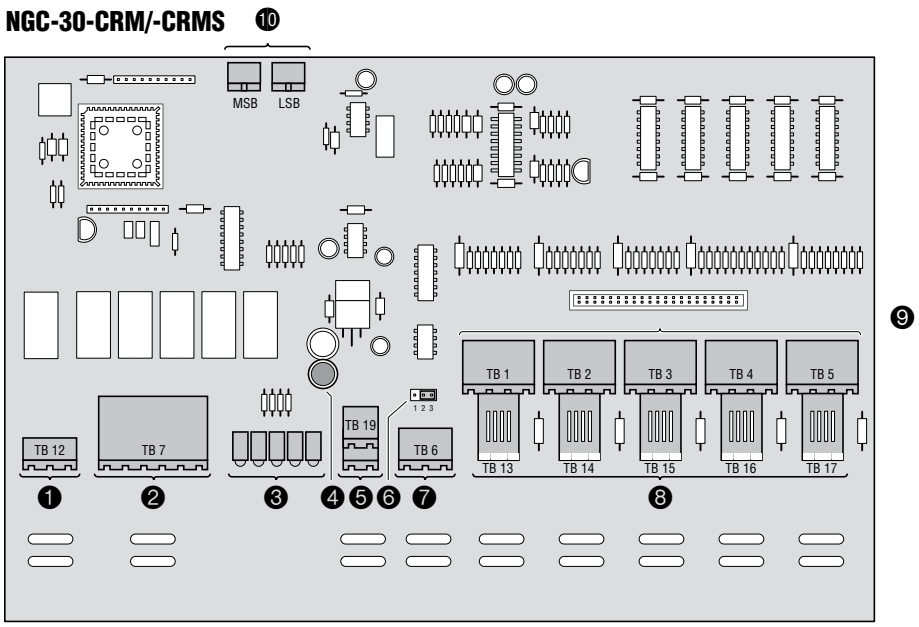


Fig. 3.6 Communication address switch

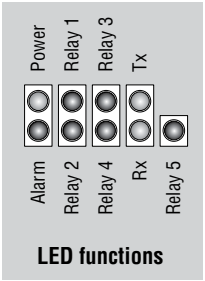
IMPORTANT: When adding an NGC-30-CRM/-CRMS to the system, power must be cycled to the board and a network update on the NGC-UIT2 must be performed.



❶ Alarm output
❷ Relay outputs (5x)
❸ LEDs (9x)
❹ Fuse
❺ 12 Vdc Inputs (2x)
❻ End of Line (EOL) jumper
❼ RS-485 Communications
❽ Line & ground-fault sensor inputs (5x)
❾ RTD Inputs
❿ Address Switches

Fig. 3.7 NGC-30-CRM/-CRMS Board l Layout

Each NGC-30-CRM/-CRMS has a cluster of nine LED lights to advise the status of the board. Number 3 in Fig. 3.7 shows the location of the LED lights.



LED function	LED description	LED color
Alarm	Energized upon Alarm	Red
Power	Energizes upon power to unit	Green
Relays 1, 2, 3, 4, 5	Energizes upon relay closed	Red
RX & TX	Energizes upon received and transmit of RS-485 data	Amber

Table 3.2 LED Display

3.3 CARD RACK (NGC-30-CR)

The Card Rack (NGC-30-CR) has the capability to house one to four Card Rack Modules (CRMs).

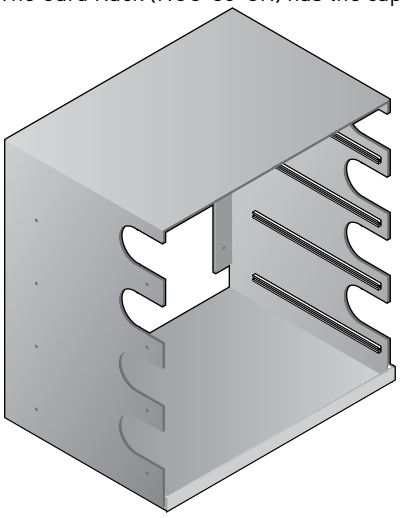


Fig. 3.8 NGC-30 card rack

3.4 VOLTAGE MONITORING MODULE (NGC-30-CVM) – OPTIONAL

The optional voltage sensor can monitor 80–290 Vac. This voltage sensor connects to one of the five line current/ground-fault inputs of the NGC-30-CRM/-CRMS
(IMPORTANT: By using the optional voltage sensors, the NGC-30-CRM/-CRMS board looses one circuit).

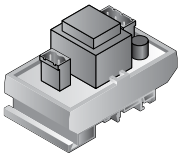


Fig. 3.9 NGC-30 voltage monitoring module

3.5 REMOTE MONITORING MODULE (RMM2) – OPTIONAL

The Raychem Remote Monitoring Module (RMM2) provides additional temperature monitoring capabilities. Each RMM2 accepts up to eight RTDs that measure pipe, vessel, or ambient temperatures. The RMM2 can be installed in the Raychem NGC-30 enclosure or can be located in the field to reduce RTD field wiring.The Raychem NGC-30 system supports 260 temperature inputs via the CRM/CRMs boards. Sixteen (16) RMM2s can be connected via a single, twisted pair RS-485 cable to provide up to 128 additional RTD inputs into the Raychem NGC-30 system.

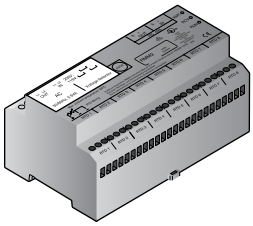


Fig. 3.10 RMM2 module

Set the RS-485 address for the RMM2 using the rotary switch provided. Note the orientation of the clear plastic cover, then remove the cover. Use a slotted screwdriver to rotate the selector switches to the appropriate positions to select the RS-485 address. The single character visible on the switch indicates the RS-485 address assigned.

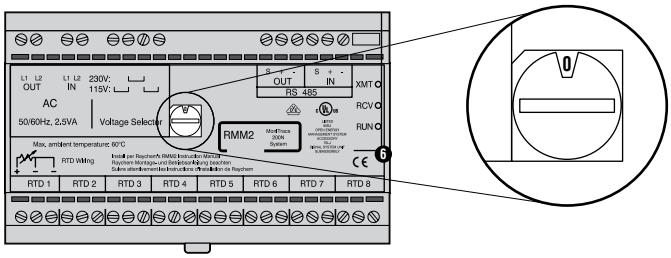


Fig. 3.11 RMM2 rotary switch

Table 3.3 RMM2 Switch Settings

RMM2 Switch Settings

Switch Settings	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
Device Address	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47

3.6 POWER LINE CARRIER INTERFACE MODULE (PLI) – OPTIONAL

Raychem PLI modules (Power Line Carrier Interface) together with Raychem temperature transmitters provide remote temperature-monitoring capability for heat-tracing control and monitoring systems by communicating the temperature data to the control system over the heat-tracing bus wires and the AC power line, eliminating the need for RTD wiring. Typical savings on the installation costs of a heat-tracing system can be as much as 30% with PLI technology, depending on the specifics of each application.

The PLI module typically resides in the NGC-30 panel and receives input from special transmitters connected to the heat-tracing. The transmitters provide pipe temperatures from RTDs and continuity confirmation; they are typically located at the front and/or end of the heat-tracing circuit. The PLI special transmitters are: Raychem SES (Smart End Seal), Raychem SPC (Smart Power Connection) and Raychem 700-TT.

The NGC-30 system can accept up to 127 temperature inputs from SES/SPC transmitters or 255 temperature inputs from 700-TT transmitters, per PLI module. Up to four PLI modules can be connected to one NGC-30 UIT2.

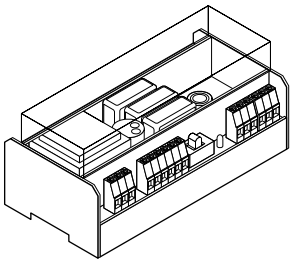


Fig. 3.12 PLI module

Set the RS-485 address for the PLI module using the rotary switches provided. Note the orientation of the clear plastic cover, then remove the cover. Use a slotted screwdriver to rotate the selector switches to the appropriate positions to select the RS-485 address. Each PLI module must have a unique address, if two PLI modules, CRM or RMM are assigned the same address, communication faults will result. The PLI module switch setting can be set from 1-99.

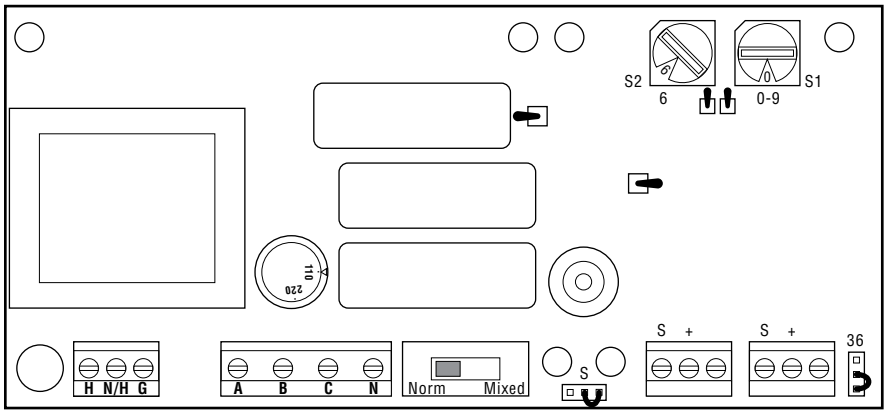


Fig. 3.13 PLI module rotary switch

SECTION 4 – APPENDICES

APPENDIX A – REPLACEMENT COMPONENT ORDERING GUIDE

Replacement Components

Description	Catalog Number	Part Number
User Interface Terminal Nonhazardous (Unclassified) Locations; indoors or outdoors, panel mounting	NGC-UIT2-ORD	10332-013
User Interface Terminal with TYPE 4 Enclosure Nonhazardous (Unclassified) Locations; indoors or outdoor, remote stand-alone mounting	NGC-UIT2-ORD-R	10332-016
NGC-30 Modules		
Card Rack Module (for EMRs)	NGC-30-CRM	10720-001
Card Rack Module (for SSRs)	NGC-30-CRMS	10720-004
Current Transformer Module	NGC-30-CTM	10720-002
Voltage Monitoring Module	NGC-30-CVM	10720-005
NGC-30 Auxiliary		
DB9F-DB9F Null Modem Cable 5 ft	NGC-UIT2-RS232	20577020
Remote Monitoring Module	RMM2	051778
Remote Monitoring Module with TYPE 4X Enclosure	RMM2-4X	523420
Power Line Carrier Interface: Smart End Seal Transmitter		
120 V temperature/continuity transmitter	SES-RTD-1	265212-000
208 – 277 V temperature/continuity transmitter	SES-RTD-2	677596-000
120 V continuity transmitter	SES-CONT-1	293536-000
208 – 277 V continuity transmitter	SES-CONT-2	398720-000
120 V Smart End Seal replacement transmitter board	SES-TT-1	815918-000
208 – 277 V Smart End Seal replacement transmitter board	SES-TT-2	771274-000
Smart End Seal Replacement RTD and stand assembly	SES-RTD-Replace	693618-000
Power Line Carrier Interface: 700-TT Transmitters		
Temperature Transmitter	700-TT-R	271095-000
Transmitter enclosure- non-haz & Div. 2 locations inclusive of RTD-300-10	700-TT-R-D2	427253-000
RTD-Used with MONI-700-TT-R-D2 & MONI-700-TT-R-OPK	RTD-300-10	129977-000
Transmitter enclosure- Div. 1 locations	MONI-700-TT-R-D1	367651-000
Transmitter enclosure for off-the-pipe non-haz & Div. 2 locations inclusive of RTD-300-10	700-TT-OPK	885215-000
Power Line Carrier Interface: Auxiliary Equipment		
Front End Filter – 480 V	MONI-700-FEF-480 V	922847-000
Front End Filter – 600 V	MONI-700-FEF-600 V	P000000312
PLI Module	PLI	488323-000
RTD lead wire, per 1000 ft reel	MONI-RTD-WIRE	962661-000
RS-485 comm. wire, per 1000 ft reel	MONI-RS485-WIRE	549097-000

APPENDIX B – PANEL SPECIFICATIONS

Panel Specifications

Table B.1 Panel Specifications

General	
Area of use	**Nonhazardous Locations** ETL LISTED CONFORMS TO ANSI/UL STD. 508 UL STD. 508A CERTIFIED TO CAN/CSA C22.2 NO. 14 9700701 Intertek **Hazardous Locations** (EMR purged version) ETL LISTED CONFORMS TO ANSI/UL STD. 508 UL STD. 508A CERTIFIED TO CAN/CSA C22.2 NO. 14 9700701 Intertek ETL LISTED CONFORMS TO NFPA STD 496 9700701 **Hazardous Locations** **(SSR version)** ETL LISTED CONFORMS TO UL STD 508A ANSI/ISA STD 12.12.01 CERTIFIED TO CSA STD C22.2 NO. 213 CSA STD C22.2 NO. 14 9700701
Approvals	
Supply voltage	100 – 240 Vac, +5% / –10%, 50/60 Hz common supply for controller and heat-tracing circuit Up to 600 Vac for heat-tracing circuit when controller is powered from a separate circuit
Enclosure	
Protection/materials	TYPE 12 (indoors painted steel) TYPE 4/3R (outdoors, painted steel) TYPE 4X/3RX (outdoors, stainless steel)
Operating Temperature	
NGC-UIT2-ORD installed	Without distribution: –13°F to 140°F (–25°C to 60°C) Below –13°F (–25°C), space heater and thermostat must be used With distribution: 14°F to 140°F (–10°C to 60°C) Below 14°F (–10°C), space heater and thermostat must be used
NGC-UIT2-HAZ installed	With or without Distribution: 32°F to 140°F (0°C to 60°C) Below 32°F (0°C), space heater and thermostat must be used
Storage Temperature	
NGC-UIT2-ORD installed	–13°F to 167°F (–25°C to 75°C)
NGC-UIT2-HAZ installed	–40°F to 149°F (–40°C to 65°C)
Relative humidity	0% to 90%, noncondensing
Control	
Heat-tracing circuits	One NGC-UIT2 can configure and monitor up to 260 heat-tracing circuits
Relay types	3-pole, electromechanical (EMR versions) 1-, 2-, or 3-pole solid-state relays (SSR versions)
Voltage, maximum	240 Vac nominal, 50/60 Hz (standard), 600 Vac nominal (optional)
Current, maximum per circuit* * Depending on panelboard amperage rating, the maximum current may not be used on all circuits.	EMR: 30 A @ 104°F (40°C) or 60 A @ 104°F (40°C) SSR: 30 A @ 104°F (40°C) or 60 A @ 104°F (40°C)
Control algorithms	EMR: On/Off, Ambient on/off, PASC (proportional ambient sensing control) SSR: On/Off, Ambient on/off, PASC (proportional ambient sensing control), Proportional (includes soft start for all SSR control modes)
Control range	–99°F to 900°F (–73°C to 482°C)
Dead band	1°F to 50°F (1°C to 50°C) (On/Off control only)

Table B.1 Panel Specifications	
Monitoring	
Temperature	
Low alarm range	–99°F to 900°F (–73°C to 482°C) or OFF
High alarm range	–99°F to 900°F (–73°C to 482°C) or OFF
Ground fault	
Alarm range	10 mA to 200 mA
Trip range	10 mA to 200 mA or OFF
Current	
Low alarm range	0 A to 100 A (where 0 equals OFF)
High alarm range	0 A to 100 A (where 0 equals OFF)
Voltage	100 – 277 Vac supply voltage to heat-tracing (IMPORTANT: Requires the loss of one circuit)
Temperature Sensor Inputs	
Monitoring	Raychem NGC-30 system can monitor up to 1040 (260 x 4) temperatures
Quantity per circuit	Up to four temperature inputs can be assigned to one circuit
Temperature sources	Hard-wired, optional RMM2 Module, optional PLI module
Temperature inputs per control point	Standard: One input standard per control point Optional: Up to three additional RTDs per control point connected via RMM2 and/or PLI Module
Temperature inputs per NGC-UIT2	Hard-wired: Up to 260 hard-wired temperature inputs, one per circuit RMM2 (optional): Up to 128 RTD inputs via RMM2 Modules. Up to 8 RTDs per RMM2 Module and up to 16 RMM2 Modules per NGC-30 controller PLI module (optional): Up to 127 RTDs via SES Transmitter (per PLI Module) Up to 127 RTDs via SPC Transmitter (per PLI Module) Up to 255 RTDs via 700-TT Transmitter (per PLI Module) Four PLI Modules per circuit, maximums 1040 RTDs
Types	100 W platinum RTD, 3-wire, a = 0.00385 ohms/ohm/°C Can be extended with a 3-conductor shielded cable of 20 W maximum per conductor (IMPORTANT: power wire and RTD wire should not be housed in the same conduit).
Alarm Outputs	
Relay outputs	3 SPDT Form C. Rating: 3 A 100 – 277 Vac Each relay may be assigned to alarm outputs
Programming and Setting	
Method	Via NGC-UIT2 (User Interface Terminal)
Units	°F or °C
Digital display	
NGC-UIT2-ORD	7 inch x 5 ¼ inch LCD color touch screen (17.5 cm X 13.3 cm)
NGC-UIT2-HAZ	10.4 inch LCD color touch screen with interval LED backlight
Memory	Nonvolatile, restored after power loss
Stored parameters (measured)	Minimum and maximum temperatures, contactor cycle count, heater time in use
Alarm conditions	Low/high temperature, low/high current, ground-fault alarm and trip, RTD failure, communications failure, relay failure, relay count, total time heater energized, contactor failure

Table B.1 Panel Specifications

User Interface Terminals (UITs)		
NGC-UIT2-ORD	Area Classification: Usage:	Nonhazardous (Unclassified) Locations TYPE 4 (indoors or outdoors)
NGC-UIT2-HAZ	Area Classification: Usage:	Nonhazardous (Unclassified) or Hazardous Locations TYPE 4 (indoors or outdoors)
NGC-UIT2-ORD-R	Area Classification: Usage:	Nonhazardous (Unclassified) Locations The NGC-UIT2-ORD-R must be installed in a nonhazardous, indoor or outdoor location. The NGC-UIT2-ORD-R connects to Raychem NGC-30 panels using RS-485 communications wiring. TYPE 4 (indoors or outdoors)
Connection Terminals		
Heating cable output	Screw terminals, 20–6 AWG (30 A versions), 14–2 AWG (60 A versions)	
Ground	14–4 AWG ground bar	
RTD / alarm / communications	28–12 AWG spring clamp terminals	
Distribution (for Raychem NGC-30 EMR only)		
Load power	120 / 208 / 240 / 277 / 347 / 480 / 600 Vac	
Standard circuit breakers	**US (United States country code in ordering details):** Square D type QOB 120 / 208 / 240 Square D type NF 277 / 480 **CA (Canada country code in ordering details):** Cutler Hammer (Canada) type BAB 120 / 208 / 240 Cutler Hammer (Canada) type GBH 277 / 480 / 347 / 600	
Circuit breaker amperage rating	120 Vac 208, 240, 277, 347, 480, 600 Vac	120 Vac 208, 240, 277, 347, 480, 600 Vac

APPENDIX C – NGC-30-CRM/-CRMS SPECIFICATIONS

Table C.1 NGC-30-CRM/-CRMS Specifications

General	
Approvals/certifications	Class I, Div. 2, Groups A,B,C,D Ex nC IIC T5 Class I, Zone 2, AEx nC IIC T5
Supply voltage	12 Vdc ± 10%
Internal power consumption	< 5 W per NGC-30-CRM/-CRMS
Operating temperature	–40°F to 140°F (–40°C to 60°C)
Storage temperature	–40°F to 167°F (–40°C to 75°C)
Environment	PD2, CAT III
Max. altitude	2000 m
Humidity	0–90% noncondensing
Electromagnetic Compatibility	
Immunity	Heavy industrial
Emission	Residential, commercial, light industrial
Temperature Sensors	
Type	100 W platinum RTD, 3 wire, a = 0.00385 ohms/ohm/°C Can be extended with a 3-conductor shielded cable of 20 ohm maximum per conductor
Quantity	Up to five wired directly to each NGC-30-CRM/-CRMS
Current Sensors	
Mounting	DIN Rail – 35 mm
Quantity per NGC-30-CTM	Five for ground-current measurement. Five for line-current measurement
Line Current Sensors	
Max. current	60 A
Accuracy	± 2% of reading
Ground-Fault Sensor	
Range	10–200 mA
Accuracy	± 4% of range at 30 A line current
Voltage Sensor	
Range	80–290 Vac 50/60 Hz
Accuracy	± 1% of span
Outputs	
CRM output relays	Form A 3-Amp @ 277 Vac max 50/60 Hz
CRMS SSR outputs	12 Vdc @ 30 mA max per output
Alarm relay	Form C 3-Amp @ 277 Vac max 50/60 Hz
Communication to NGC-UIT2 or 200N	
Type	2-wire RS-485
Cable	One shielded twisted pair
Length	4000 ft. (1200 m) maximum* ***IMPORTANT:** May require an RS-485 repeater if communication length is greater than 4000 ft.
Quality	Up to 52* NGC-30-CRM/-CRMS may be connected to one NGC-UIT2 Up to 16 NGC-30-CRM/-CRMS may be connected to one 200N
Connection Terminals	
Power supply/pilot relay/RTD/ comm port (RS485)	18–12 AWG (0.8 - 3.3mm2)

APPENDIX D – NGC-UIT2 SPECIFICATIONS

Table D.1 NGC-UIT2-ORD Specifications

General	
Approvals	NGC-UIT2-ORD **Nonhazardous Locations** C US LR67275 CE
	NGC-UIT2-ORD-R **Nonhazardous Locations** C US CE
Area of use	Nonhazardous, indoors or outdoors (IP65, TYPE 4)
Supply voltage	9 – 30 Vdc, 3.6 – 1.2 A
Operating temperature	–22°F to 140°F (–30°C to 60°C)
Minimum storage temperature	–22°F to 176°F (–30°C to 80°C)
Dimensions	11" W X 9" H X 2.75" D (279 mm W X 229 mm H X 70 mm D)
Alarm Outputs	
Transistor open collector outputs	Three open collector outputs, with a range of 5 – 30 Vdc with a max. sink current of 500 mA
Use to drive external relays	Relays may be assigned for alarm outputs
LCD Display	
Display	LCD is a 8.4 inch XGA, color TFT transflective device with integral LED backlight
Touch screen	5-wire resistive touch screen interface for user entry
Network Connection	
Local/Remote Port	RS-232/RS-485 ports may be used to communicate with host computers (Raychem Supervisor Software) or DCS
Local RS-232	A non-isolated, 9 pin D sub male
Remote RS-485 #2	2-wire isolated, 9 pin D sub male
Data rate	Data Rate 9600 to 57600 baud
Maximum cable length	For RS-485 not to exceed 4,000 ft (1,200 m). Cable to be shielded twisted pair.
Field Port	RS-485, 2-wire isolated. Used to communicate with external devices, such as NGC-30-CRM and RMM2. Maximum cable length not to exceed 4,000 ft (1,200 m). Cable to be shielded twisted pair.
Field RS-485 #1	2-wire isolated, 9 pin D sub male
Data rate	Data Rate To 9600 baud
LAN	10/100 Base-T Ethernet port with Link and Activity Status LEDs
USB Ports	USB 2.0 Host port Type A receptacle (X2)

Table D.2 NGC-UIT2-HAZ Specifications

General	
Approvals / Certifications Hazardous Locations Class I, Division 2, Groups A,B,C & D	NGC-UIT2-HAZ E212370 UL 60950-1 & CSA C22.2 No. 60950-1
Area of use	Nonhazardous or hazardous locations, indoors or outdoors (Type 4X, IP66)
Supply voltage	90-240 Vac
Operating temperature	32°F to 140°F (0°C to 60°C) without space heater –22°F to 140°F (–30°C to 60°C) with space heater
Minimum storage temperature	–40°F to 149°F (–40°C to 65°C)
Dimensions	13.43 in W X 10.87 in H X 3.63 in D (341 mm W X 276 mm H X 92 mm D)
Alarm Outputs	
Via External Alarm Module	Three relay output, Form C contacts, switching module up to 250 Vac/5 A
User to Drive External Relays	Relays may be assigned for alarm outputs
LCD Display	
Display	LCD is a 10.4 in SVGA, color TFT transflective device with integral LED backlight
Network Connection	
Local/Remote Port	RS-232/RS-485 (via external converter) ports may be used to communicate with host computer (Raychem Supervisor Software) or DCS
Local RS-232	A non-isolated, 9 pin D sub male
Remote RS-232 to RS-485 using external converter #2	2-wire isolated, Using a standard 9 pin D sub female to 9 pin D sub male cable.
Data rate	9600 to 57600 baud
Maximum cable length	For RS-485 not to exceed 4,000 ft (1,200 m). Cable to be shielded twisted pair.
Field Port	RS-232/RS-485 (via external converter) port used to communicate with external devices, such as NGC-30-CRM, CRMs and RMM2.
Field RS-232 to RS-485 using external converter #1	2-wire isolated, using a standard 9 pin D sub female to 9 pin Dsub male cable.
Data rate	9600 baud
Maximum Cable Length	For RS-485 not to exceed 4000 ft. (1200m). Cable to be shielded twisted pair.
LAN	10/100 Base-T Ethernet port with Link and Activity Status LEDs
USB Ports	USB 2.0 Host port Type A receptacle (X2)

APPENDIX E – DEVICE ADDRESS

Table E.1 Device Address

Device	Device Type	Switch Setting	Device Address
NGC-30-CRM/-CRMS	Relay Output/RTD	1–99	1–99 (If RMM2s are equipped or will be added in the future, skip addresses 32–47)
RMM2	RTD	0	32
RMM2	RTD	1	33
RMM2	RTD	2	34
RMM2	RTD	3	35
RMM2	RTD	4	36
RMM2	RTD	5	37
RMM2	RTD	6	38
RMM2	RTD	7	39
RMM2	RTD	8	40
RMM2	RTD	9	41
RMM2	RTD	A	42
RMM2	RTD	B	43
RMM2	RTD	C	44
RMM2	RTD	D	45
RMM2	RTD	E	46
RMM2	RTD	F	47
PLI module	RTD	1-99	1-99

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